TSUNAMI
"El Peligro Olvidado"
The Forgotten Danger !

A Risk-to-Life Assessment: Western Atlantic Basin Beaches (including Caribbean and U.S. East and Gulf coastlines)

Informational Briefing at National Weather Service Headquarters
Silver Spring, Maryland, 08/14/06

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Overview

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- "***El Peligro Olvidado***" – i.e. "*The Forgotten Danger*"….An appropriate Spanish nickname for a deadly phenomena with a *disarmingly low frequency*.
- The hard lesson from the catastrophic Indian Ocean event… despite tsunami infrequency, recent large coastal population growth & explosive tourism (warm water attraction) has resulted in enormous potential for loss of life.
- What are the most vulnerable areas for loss of life? *The beaches – obviously, they are at sea-level.*
- In all such beaches, a 3-meter tsunami causes high mortality.
- We have entered a new era requiring a greater regional commitment to tsunami preparedness and warning systems.

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Assessing Risk

***Risk (total)**
= Hazard x Element at Risk x Vulnerability

Applied to tsunamis:
Hazard: rate of occurrence or probability
Element at Risk: human life
Vulnerability: lives exposed to tsunamis

***Source:** J. Nott (2006): *Extreme Events – Physical Reconstruction and Risk Assessment,* Cambridge University Press.

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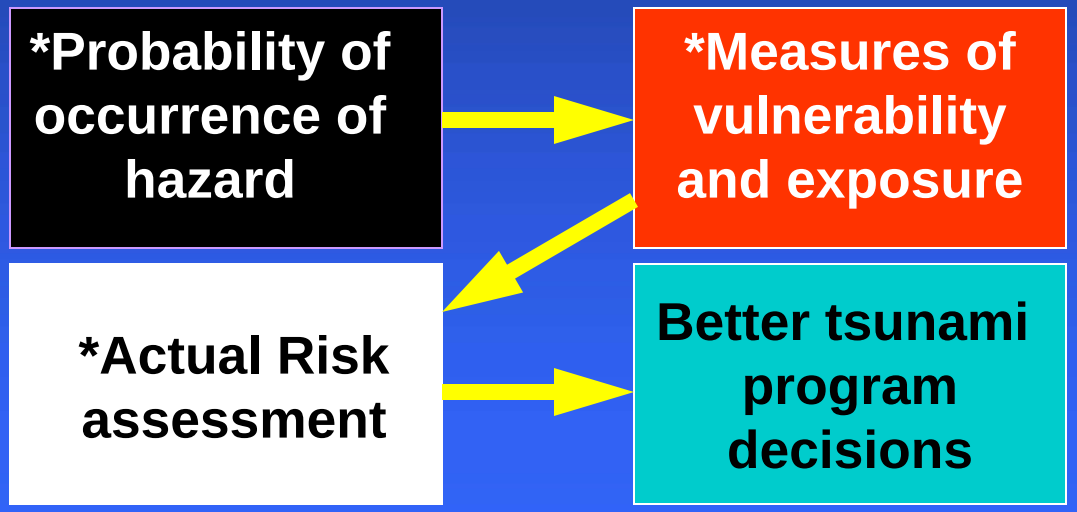
Assessing Actual Risk !

We need to assess current vulnerability to determine actual risk. Thus we must add today's population to tsunami history and frequency to properly assess relative risks.



***Source:** J. Nott (2006): Extreme Events – Physical Reconstruction and Risk Assessment, Cambridge University Press.*

^University of Puerto Rico at Mayaguez

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Western Atlantic Basin (includes Caribbean) Tsunami Fatalities in the last 165 Years

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Date	Place	Fatalities
1842	Haiti	~300+
1853	Venezuela	600-4000
1867	Virgin Islands	23
1882	Panama	75-100
1906	Jamaica	500
1909	Louisiana	300
1918	Puerto Rico	140
1929	Newfoundland+, Canada	29
1946	Dominican Republic(1)	1790
1946	Dominican Republic(2)	75
TOTAL		**3832 to 7257**

Statistics from ***Caribbean Tsunamis, A 500-Year History from 1498-1998*** by Karen Fay O'Loughlin and James F. Lander (ISBN 1-4020-1717-0 2003 edition) and Tsunamis of the Eastern US, NGDC, 2002 Science of Tsunami Hazards, vol 20, #3, pg 120

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Caribbean Tsunamis

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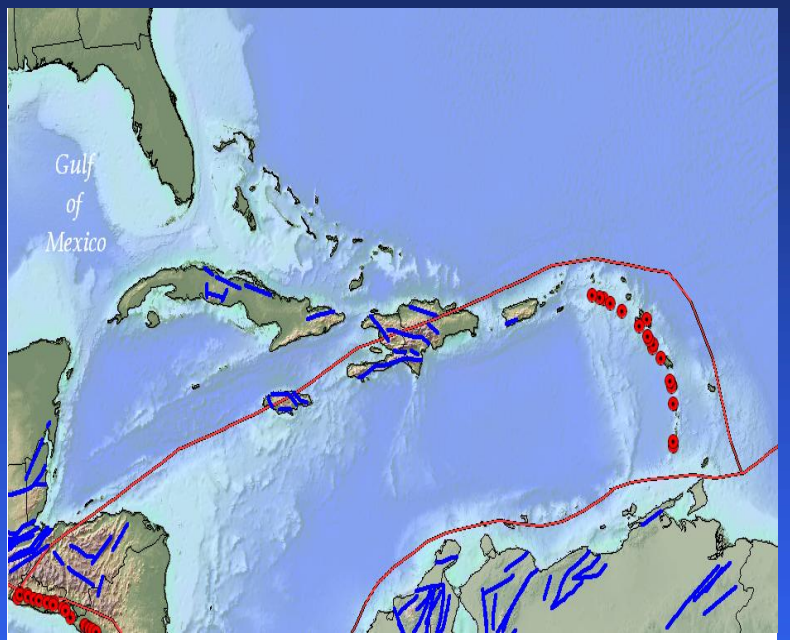
- Last major Western Atlantic basin tsunami event: 1946, lives lost: 1865*
- Since then, population shifts to coastal communities and “explosive” tourism (millions of Americans make it their vacation spot) has taken place.
- Risk assessment based on historical deaths will greatly understate today’s potential loss of life from Caribbean tsunamis.
- Despite the population at risk having been so much smaller in the past, at least 3503 lives* have been lost in the Caribbean Basin in the last 165 years.



Volcano locations, fault lines & plate boundaries are plentiful in the Caribbean

*Statistics from ***Caribbean Tsunamis, A 500-Year History from 1498-1998*** by Karen Fay O'Loughlin and James F. Lander (ISBN 1-4020-1717-0 2003 edition)

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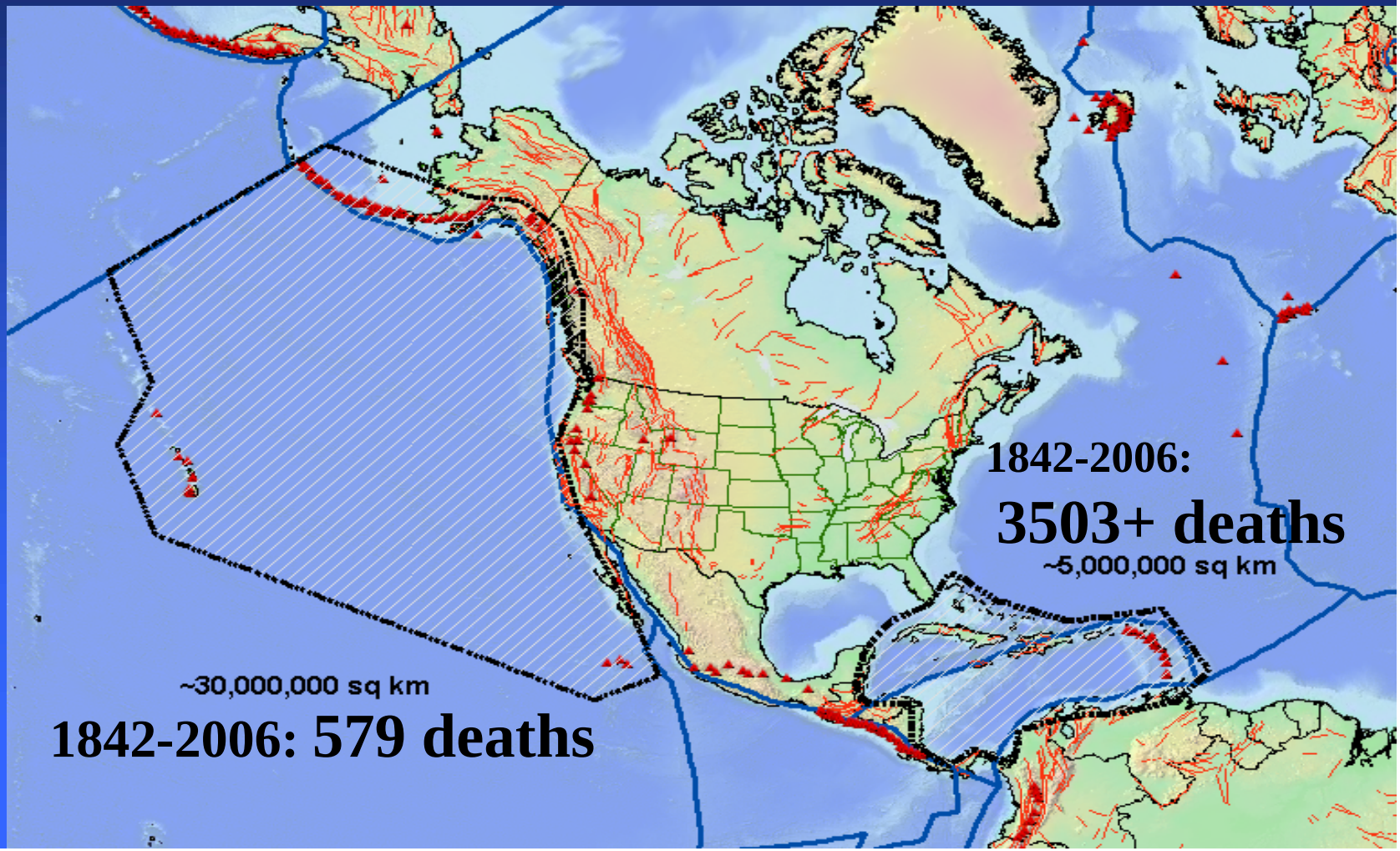
Tsunami deaths since 1842 between two active tsunami basins….Both of much concern to the USA, the North-American Pacific coasts including Hawaii, and the Caribbean Basin including Puerto Rico & US Virgin Islands



Most Caribbean tsunamis are caused by nearby sources

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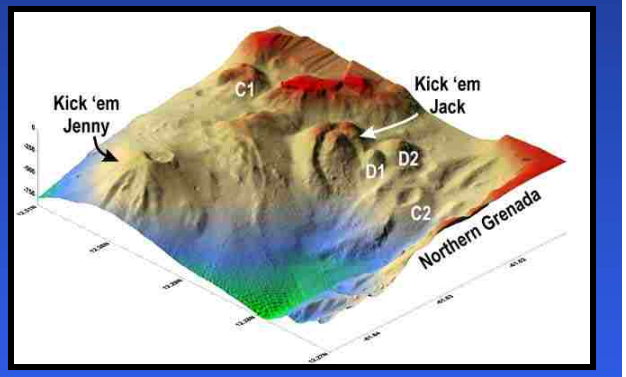
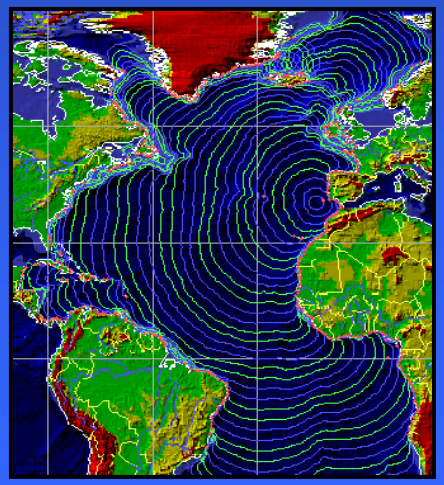
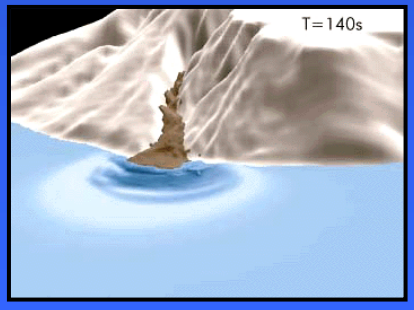
- Earthquakes (many subduction areas/faults exist in the Caribbean
- Landslides (continental shelfs and trenches)
- Submarine and Land Volcanoes
- Tele-tsunamis (e.g. “Lisbon” Nov. 1, 1755)







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The Tsunami Threat to the US Atlantic/Gulf Coasts*

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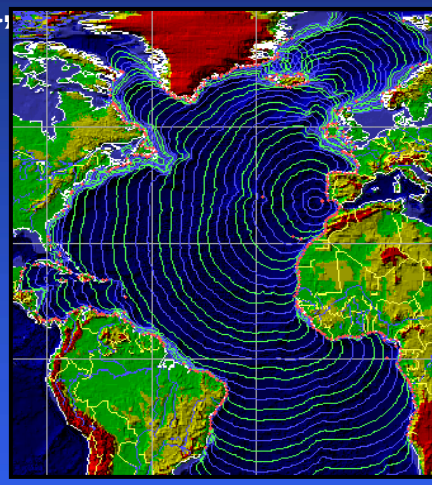
*Ref: Tsunamis… of the Eastern United States by NGDC, 2002. Science of Tsunami Hazards, Volume 20, #3, pg 120: "The threat of tsunamis hitting the eastern U.S. is very real despite a general impression to the contrary."

- Lisboa Earthquake11/01/1755 with its tele-tsunami of up to 7-10m in the Leewards, to Cuba; possible 3m waves to Florida, Newfoundland etc.
- Cape Ann Earthquake 11/18/1755 with its tele-tsunami felt from Nova Scotia to St. Martin
- Long Island tsunami 6/18/1871, New York Times
- Charleston Earthquake 08/31/1886, Tsunamis Mayport to Jacksonville, Florida Times Union
- Grand Isle to Vermillion Parish tsunami 09/22/1909, 300 deaths, possibly landslide triggered
- Great Banks Earthquake 11/18/1929, 29 deaths in Newfoundland and Nova Scotia and felt to Azores and Portugal. Tide gages affected from Charleston to Maine
- Many more events documented along Eastern and Gulf coasts all the way to Brownsville, Texas.



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Today's risk to beach life from a 3-meter + *Tele*Tsunami

Beach area & history glimpse	Est'd Freq.	Beach Water Temp °F	Est'd Daily Beach Attend-ance	Impact with only 10% Loss of Life	Prior Simple Risk	Today's Actual Risk to Life
Caribbean Region (last event 1755) (*3)	1/250 yrs (*3)	Warm (80+°F) (*1)	1000K (*4)	100K per event or 40K per century	Low	High
3 West Coast States (last event 1964) (*2)	1/100 yrs (*2)	Cold (65°F) (*1)	40K (*4)	4K per century	High	High

Caribbean Beaches have a potential for loss of life to be *10 times higher* for a tele-tsunami.

Today's risk to beach life from a 3-meter + Tsunami

Beach area, population and annual tourism	Est'd Freq.	Beach Water Temp °F	Est'd Daily Beach Atten-dance	Impact with only 10% Loss of Life	Prior Simple Risk	Today's Actual Risk to Life
Caribbean Rgn Nations population 64,500K with 100,000K visits (*4)	3/100 yrs (*3)	Warm (80+°F) (*1)	1,000k (*4)	100K per event or 300K per century	High	Highest
State of Hawaii population 1,265K with 63,240K visits (*4)	4/100 yrs (*2)	Warm (80°F) (*1)	100k (*4)	10K per event or 40K per century	High	High

Caribbean beaches have a potential for loss of life to be more than ***7 times higher*** for local tsunamis per century.

Today's risk to beach life from a 3-meter + Tsunami

Beach area, state population and annual tourism	Est'd Freq.	Beach Water Temp °F	Est'd Daily Beach Atten-dance	Impact with a 10% Loss of Life	Prior Simple Risk	Today's Actual Risk to Life
Florida Population: 17,400K with 85,100K visits(*4)	1/200 yrs (*3)	Warm (80+°F) (*1)	400K east coast & straits (*4)	40K per event or 20K per century	Low	High
Alaska Population: 650K with 1,725K visits (*4)	4/100 yrs (*2)	Frigid (45 °F or less) (*1)	5K (*4)	½ K per event or 2K per century	High	High

East Coast FL beaches have a potential for loss of life to be ***10 times higher*** for any tsunami. Rogue waves add to these Florida numbers.

Other sources of data and footnotes.

- *1 – NOAA Sea Surface Temperatures.
- *2 - NOAA National Geophysical Data Center.
- *3 - Landers, Lockridge, Whiteside, O’Loughlin.
- *4 - The populations and tourism numbers were taken from state government or tourism sources within Alaska, Florida, Hawaii. The Caribbean numbers were taken from tourism sources.

A Few Reminders….

- Like the Indian Ocean, the year-round warm ocean temperatures of the Caribbean beaches and the seasonal warm ocean temperatures along the Gulf and Atlantic coastal areas are a strong attraction to residents and tourists.
- Beaches with flat, low-lying topography maximize beach attendance while offering minimal opportunity to climb away from tsunami harm. Such flat topography is more prevalent along the U.S. Atlantic coastal States and the Caribbean in contrast to the U.S. Pacific coastal States including Alaska.

Some Sobering Thoughts

- The Indian Ocean and our Atlantic Basin have a lot in common in addition to warm waters and similar topography. NOAA Geophysical Data Center says our Caribbean Basin has had 8% of the world's tsunami events and the Indian Ocean, 7%. Yet an Indian Ocean tsunami on 12/26/04 caused horrific devastation....over 300 thousand deaths !
- Vital and timely tsunami local warnings using regional expertise, research, real-time observations, education and communications will save enormous numbers of lives !

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Questions or Comments?

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Fort Worth, Texas

- This presentation is available at **http://www.srh.noaa.gov** by
- clicking on the “Message from the Director” and
- selecting the “Tsunami Risk-to-Life Assessment” presentation.

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